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## ENTOMOLOGY.

WITLACZIL ON PSYLLIDÆ.<sup>1</sup>—In 1883 Dr. Witlaczil published his researches on the anatomy of the Aphides, and in 1884 on their embryology (of which paper we gave an abstract in AMERICAN NATURALIST, Feb., 1885). He now furnishes an additional contribution to the anatomy of the Phytophthira, or plant-lice, making the small group of Psyllidæ the subject of important researches; his exposition of the structure of the insect brain being of exceptional value. The species examined by him represented the genera Psyllopsis, Rhinocola, Psylla, Homotoma, Trioza. His methods were teasing in saline solutions, treating with dilute acetic acid the fresh and stained animals entire and making sections in the Naples way with Jung's microtome.

In external appearance the Psyllidæ are small (about a millimeter in length) differing from other families of Homoptera by the similarity of both sexes, which are winged and are provided with a pair of compound eyes and three simple ocelli, and have ten jointed antennæ, the two joints next the base short and thick, and the terminal joint bearing a pair of bristles. During life the antennæ are constantly vibrating. Figs. 1, 2 show the male,

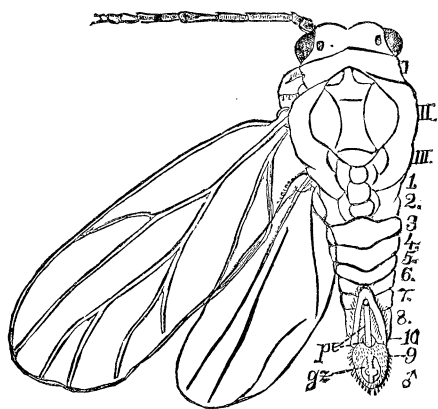


Fig. 1.

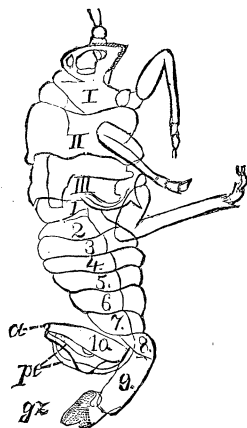


Fig. 2.

FIG. 1.<sup>2</sup>—*Psyllopsis*, ♂, dorsal view, right wings removed. FIG. 2.—The same, lateral view, wings removed.

<sup>1</sup> Die Anatomie der Psylliden, von Dr. Emanuel Witlaczil in Wien. Zeitschrift für Wissenschaftliche Zoologie, Vol. XLII (1885), pp. 560-658, and pl. xx-xxii.

<sup>2</sup> Explanation of reference-letters in the figures.—*a*, anus; *al*, antennal lobe; *an*, abdominal nerve; *at*, antenna; *ats*, antennal swelling; *cb*, central body of brain; *cp*, crop; *es*, eye swelling; *ga*, ganglion; *gz*, genital hooks; *h.in*, hind-intestine; *id*, inner decussation; *ln*, limb nerve; *mb*, mushroom body; *Mg.v*, malpighian vessels; *m.in*, mid-intestine; *ml*, mid-lobe of brain; *oc*, compound eye; *ocl*, ocellus; *od*, outer decussation; *oes*, cesophagus; *om*, outer medullary layer; *pe*, penis; *rc*, rectum; *s.oe*, sub-cesophageal ganglion; *st*, stomach; *vn*, ventral nerve-cord. Roman numerals indicate thoracic somites and Arabic numerals abdominal somites.

whose abdomen is slightly compressed. The abdomen of the female is rounded. The wings of these insects and of the winged forms of Aphides are used chiefly as parachutes. The coxæ of the limbs coalesce with the thorax, and the tarsi are two-jointed, bearing a pair of terminal claws. The hind-limbs are specialized for springing. The first abdominal somite of both sexes is added to the metathorax to enlarge the springing-gear; the second abdominal somite forms a short stalk for the abdomen, and the terminal abdominal somites are so modified as to have misled the systematists. In the male the tenth somite seems to be inserted on the eighth, as the ninth has only its ventral part developed and ends the abdomen, whilst the tenth, bearing the anus and penis, is reverted dorsad. In the female the ninth somite is discernible only by its appendages, and the tenth is a roofing dorsal plate (the upper genital dorsal plate of Löw) bearing in its center the anus fringed by wax-glands. Thus in both sexes the typical number of ten somites can be found.

The circum-anal wax-glands are in the larvæ of both sexes; and wax-glands producing wax-fibrils are present on other parts. Wax-particles sometimes cover the larvæ, protecting the back from excrementitious matter. Some larvæ (*Psyllopsis*) have spear-shaped wax-hairs; the larva of *Trioza* has a marginal row of leaf-like wax-plates. All the wax-hairs arise like chitinous hairs from large hypodermal cells, which have vacuoles presumably filled with the secretion-fluid.

The stigmas of the tracheal system are denticulated on each side, and have a self-acting closing apparatus (not as described by Landois). They have a short muscle on the ventral side, so connected with the dorso-ventral muscles of the body that on the contraction of these muscles the stigmatic muscle contracts and opens the valve. This is probably for expiration. Inspiration is effected by the mere elasticity of the tracheæ, and the stigmatic valve closes by its own elasticity. The will of the insect does not control these movements.

The *nervous-system* and *sense-organs* are here treated relatively to insects in general, and much new light is cast on the subject of the insect's psychology. The brain of the *Psyllidæ* is rather large, having a middle lobe and two lateral lobes, the latter sending off the optic nerves (Figs. 3, 4).

The median lobe is prolonged downwards into the procephalon.<sup>1</sup> Its posterior part becomes the two commissures leading to the subœsophageal ganglion, from which the mouth-organs are innervated. The ventral nerve-cord has four ganglia, three for the limbs and a fourth for the abdomen whose ganglia are fused into a single mass. The brain-mass is much as in other insects, having a central medullary system and a peripheral layer of a cortex

<sup>1</sup> Thus I render *Vorderkopf*; "procephalic-lobes" is inaccurate, as the part is not paired; the term "forehead" is preoccupied.—*G. M.*

of ganglion-cells which fails only at its posterior part. The ganglion-cells are polygonal or roundish, varying in size; they have a horny nucleus, and become stained whilst the medullary part remains clear.

The *compound eyes* are well described by Viallanes (Ann. des Sci. Naturelles, 1882) for *Musca*. In *Psyllidæ* they are somewhat simpler, having (1) at the surface numerous separate lenses of the cornea, slightly biconvex, (2) below them a layer of crystalline cones, often brownish, (3) next comes a dark layer of rhabdites forming the retina; each rhabdite being a slender truncated cone,

narrowing inwards. The whole system of rhabdites converges towards the center of the eye, whence nerves run towards the brain. The subsequent layers of Viallanes (post-retinal fibers, ganglion cell-layer, palisade-layer and chaplet-cells) cannot be clearly recognized in *Psyllidæ*. The retinal fibers pass by the

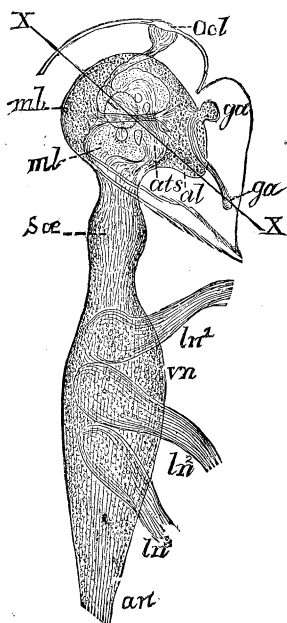


Fig. 3.

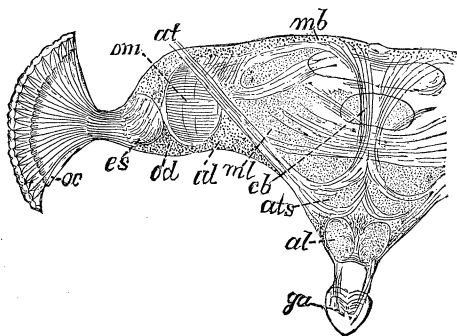


Fig. 4.

FIG. 3.—Nervous system of *Psylla*. FIG. 4.—Transverse section of brain of *Psylla*, along line X X of Fig. 3.

ganglion cell-layer into the “eye-swelling” (*es* of Fig. 4) (the optic ganglion of Viallanes), an enlargement of the medullary substance. The fibers passing this way toward the median brain-mass form an “outer decussation” (*od*). Some fibers from this decussation go to the adjoining cortex, some to the outer part of the medullary layer, some pierce this so as to reach the inner decussation (*id*), and some proceed thence across the brain so as to form a chiasma with fibers from the opposite eye. Some fibers from the eyes and some from the other outer lobes of the brain find their way to the *central body* (Fig. 4, *cb*) in the mid-lobe, and nerves may be traced from all these lobes and from the central

body to the anterior cortex of the brain with its abundant ganglion-cells.<sup>1</sup>

The *simple eyes* have biconvex lenses and rhabdites joined to nerve fibers, which run back to the infero-posterior region of the brain, and thence advance so as to enter the central body. The antennal nerves run straight back to the antennal lobes (*al*), whence some fibers run forwards to the central region of the brain.

The "central body" has been described by investigators as a fan-shaped organ. Packard,<sup>2</sup> after Newton, described it as a half-moon-shaped body, concave backwards and separated by a network of fibers from the brain, and supposed it to consist of modified cells. In *Psyllidæ* it is bean-shaped, consisting of granulated matter not at all isolated from the surrounding parts of the brain, but receiving fibers from and sending fibers to the other lobes, and is nothing more than a central commissural system, its cell-like elements being the cross-sections of fibrous masses.

The *mushroom-bodies*, described by authors, are found in *Psyllidæ* only in a rudimentary form, being some thick masses of ganglion-cells in the upper anterior border near the median line, whence bundles of fibers run backwards.

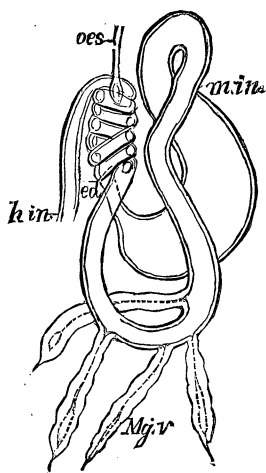


FIG. 6.—Digestive tract of *Psyllopsis*.

Taken as a whole the brain, with its connections with procephalic ganglion-masses, subcesophageal commissures and ventral nerve-cord, and various lobes in its own mass, is complex; and it is scarcely possible to join sections made in different directions into a unity, so as to get its real structure. As a whole its inner part is a central nerve system consisting of fibrous masses, which on the one side end in a sense-organ or in a peripheric nerve, and on the other in a cortical layer of the brain, entering its ganglion-cells. The insect-brain is, therefore, a projection-centrum, the mushroom-body being special. The most important nerves entering the brain (as from the eyes, antennæ, limbs) cause a swelling in its medulla, where the fibers are deflected so as to change their course.

*Digestive tract.*—The mandibles and first maxillæ are developed

<sup>1</sup> S. J. Hickson (in *Quarterly Journal of Microscopical Science*, April, 1885) uses the terms *opticon*, *epiopticon* and *periopticon* for three medullary masses belonging to the eye of *Musca*; representing respectively *om*, *es*, and a tract near *oc* of our Fig. 4.—*G. M.*

<sup>2</sup> Second report U. S. Entomol. Commission, 1878–9. The literature of the subject is there given.

into "retort-shaped organs," and the second maxillæ form a short under lip which is inserted on the short prothorax. The piercing stylets are very long, lying in a groove of the under lip, and at their base forming loops which are enclosed in a dermal sac. This is the structure also in Coccidæ, as Dujardin and Mark shew [and is well seen in the larval seventeen-year Cicada.—*G.M.*]. The œsophagus is narrow, extending as far as the abdomen, where the stomach and beginning of the mid-intestine coalesce with the hind-intestine (Fig. 5), the two parts winding round each other in several turns. This coalescence is caused by the contraction of the mid-intestine. Mark shews that in Coccidæ the arrangement is different, the end of the œsophagus and beginning of the stomach having a small winding loop which is received into a sac formed by the hind-intestine. This latter is also the way in Cicadidæ. The malpighian vessels are four, short and distinct, their ends running into a suspensory ligament. They are wanting in Aphides and Chermetidæ.—*G. Macloskie.*

ENTOMOLOGICAL NEWS.—A paper by Dr. E. Witlaczil, on the morphology and anatomy of the bark lice (Coccidæ) appears in *Zeitschrift für Wissens., Zoologie*, issued Dec. 31, 1885.—Dr. R. von Limbeck has investigated (*Litzungsber. K. Akad. Wissenschaften*, Wien, 91, 1885, p. 322) the histology of the yellowish-brown and white muscles of insects; the former are thoracic and belong to the wings, the latter are abdominal muscles, and largely form those moving the hind limbs.—According to *Science* for Jan. 15, the city of Mexico has for a number of months past been afflicted with a scourge of mosquitoes, which have abounded so as to cause sickness, and, it is said death, by their poisonous bites.—The grand prize in anatomy and zoölogy of the French Academy has been given to Dr. J. Chatin for a work, as yet unpublished, on the tactile organs of insects and Crustacea.—The Transactions of the Entomological Society of London, Dec. 2, 1885, contain an interesting life-history of a trap-door spider (*Atypus piceus*), by F. Enock; also an essay on the classification of the Australian Pyralidina, by F. Meyrick. He divides the group into thirteen families, and estimates the number of described species throughout the world at 2500. He thinks that the Phycidæ may be regarded as a development of the Galleriadæ, the Botydidæ of the Scopariadæ, and the Hydrocampidæ and Musotimidæ of the Pyralididæ. \* \* \* The Tineodidæ (formed for the reception of the genus *Tineodes*), Oxychirotidæ, Pterophoridæ, and Alucitidæ on relics of a once more extensive section of the group, now reduced to a fragmentary condition, and approaching most nearly to the Crambidæ and Scopariadæ."